SD
395
S64
No. SO-ITF-SM-28

Fraxinus uhdei (Wenzig) Lingelsh. — Fresno, tropical ash

Oleaceae — Olive family

SO-ITF-SM-28
March 1990

U.S. Forest Service
Pacific Southwest Library and Information Center
1323 Club Drive
Vallejo, CA 94592-1110

John K. Francis

Fraxinus uhdei (Wenzig) Lingelsh, known as fresno or tropical ash, is a handsome, medium to large sized tree that reaches a maximum height of 37 m (*1*, fig. 1). This tree species is planted for shade and shows potential for plantation forestry.

HABITAT

Native Range

The native range of fresno stretches from west central Mexico through Guatemala, from latitudes 25° to 14° N. (*8*, fig. 2). The species has been introduced for forestry purposes in Hawaii, Puerto Rico, and India (*2, 11, 21*). It also has been planted as a shade tree in Costa Rica and in subtropical areas of the United States (*8, 11, 19*).

Climate

Mean annual precipitation in the native habitat ranges from 800 to 3000 mm (*25*). Almost all precipitation falls during the May through October period (*9*). Mean temperatures vary from 15 to 20 °C in January to 20 to 25 °C in July (*25*). Frosts are infrequent and light.

Soils and Topography

Fresno is a site-sensitive species; many plantations have stagnated because of unfavorable site conditions. The only reference in the literature as to soil preference in the native range states that fresno usually grows along streams (*24*). Observations in Puerto Rico and a report from Hawaii (*15*) indicate that it grows best on alluvial or colluvial soils but poorly on eroded slopes and dry ridges. Fresno appears to grow at moderate rates on stoney muck soils (*29*) and on moist, nutrient-poor ultisols on the upper slopes. Most of the native range in Mexico lies above 2,400 m (*13*). In Guatemala, the range extends from 800 to 2,000 m in elevation (*24*). The best growth in Hawaii was attained at elevations between 450 and 1,500 m (*15*).

Associated Forest Cover

Only sketchy information could be found regarding associated tree species. Forest types in which fresno is found are usually dominated by oaks (*Quercus* spp.) (*9*). Between the ancient farming areas of Puelda and Texmelucan, Mexico, fresno grows along watercourses with *Alnus glabrata* Fernald, *Salix bonplandiana* H.B.K., *Buddleia cordata* H.B.K., *Schinus molle* L., and *Populus* spp. (*20*).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—The small dioecious flowers are borne in large panicles 13 to 20 cm long (*11*). The seeds are paddle-shaped samaras 2.5 to 4 cm long (*23*). The season in which seeds are produced in the native range was not given in the literature. Flowering in Hawaii occurs between March and May, with fruit ripening and falling between July and September (*1*). Flowering has been noted in November and January in Puerto Rico[1], and one seed sample was collected in Puerto Rico in August (*11*).

Seed Production and Dissemination.—Seeds were first produced on plantation trees in the sub-Himalayan region of India on 9-year-old trees (*21*) and in Hawaii on 15-year-old trees (*4*). Plantations in Puerto Rico (*11*) have also produced seeds, which are produced abundantly (*15*). Seedlots from Mexico averaged 47,225 seeds per kilogram and ranged from 39,500 and 54,900 seeds per kilogram (*17*). Fresno seeds, like those of other *Fraxinus* species, disseminate by spiraling downward and outward from the mother tree. Sown seeds begin germination in 40 days (*1*). No scar-

Figure 1.—*Fresno* (Fraxinus uhedi) *on a plantation in Puerto Rico.*

John K. Francis is research forester at the Institute of Tropical Forestry, Southern Forest Experiment Station, USDA Forest Service, Rio Piedras, PR, in cooperation with the University of Puerto Rico, Rio Piedras, PR.

[1]Personal communication, Henri Liogier, Taxonomist, University of Puerto Rico, Rio Piedras, PR.

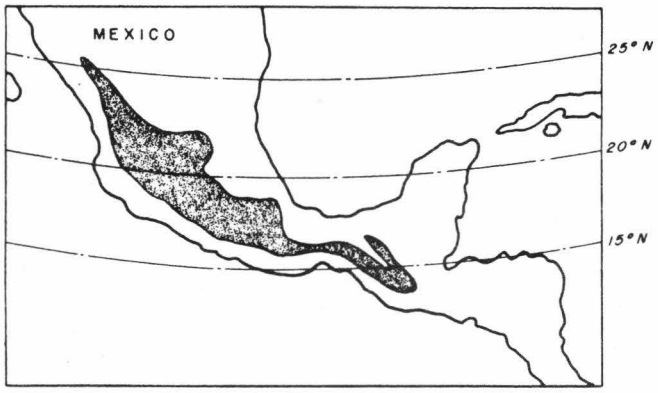

Figure 2.—*Approximate native range of fresno* (Fraxinus uhedi) *in Mexico and Guatamala.*

ification is necessary. Seeds may be collected from the trees after they turn from green to gold, or seeds may be swept up from streets or other smooth surfaces after they fall. They can be stored at 5 °C after being dried to a 7- to 10-percent moisture content (*1*).

Seedling Development.—Germination of fresno is epigeal. Published information was not found regarding the best nursery practices, but in line with successful practice used for most tropical species, seedlings should be transferred from the germination bed to nursery bags when they reach 5 to 10 cm in height. Seedlings should then be grown under shade until they reach about 50 cm in height, and should be hardened in full sunlight before planting in the field. Planting with bare-root stock also works quite well (*4*). Survival in both Hawaii and Puerto Rico has been very high.

Vegetative Reproduction.—Fresno coppices very well. Coppicing of trees 2 to 8 years old to improve form resulted in 95 to 100 percent of the trees producing sprouts (*27, 28*). Seventy percent of the cut stumps had at least one vigorous sprout 5 years later (*32*). Suckering (sprouting) from exposed roots was observed in Puerto Rico. If the species behaves like the closely related *F. americana* L., grafting should be easy (*34*). Cuttings from the tip portion of stump sprouts root readily[2].

Sapling and Pole Stage to Maturity

Growth and Yield.—On good sites, fresno grows about 1 m/yr in height in its early years. The rate gradually decreases as the tree ages. Some average heights and diameters for successful plantations in Hawaii and Puerto Rico are given in table 1. Diameter growth stays fairly constant at about 1 cm/yr, enabling fresno to reach large sizes. Under favorable conditions in Hawaii, trees were reported to reach 30 m in height and 61 cm in diameter at breast height (d.b.h.) at 37 years (*15*). One 54-year-old roadside tree in Puerto Rico was 32 m tall and 110 cm in d.b.h. In Hawaii, an annual production of 13 to 21 m^3/ha was reported for stands ranging from 38 to 43 years old (*2*). One 25-year-old stand in Puerto Rico yielded 11.5 m^3/ha/yr. An optimal rotation age has not been established. However, to reach merchantable saw log sizes, fresno will need from 30 to 60 years, depending on site quality.

Rooting Habit.—Roots of fresno grow thick near the soil surface and can be quite destructive to sidewalks and curbs (*26*). When used as a shade tree, they should be planted well back from the pavement. Buttresses do not develop in this species. Short adventitious roots develop on lower trunks under very humid conditions (*10*).

Reaction to Competition.—Fresno is usually planted at 3- by 3-m spacings (*28*) and weeded until it emerges above herbaceous competition. Both grid and line planting methods have been successful. A study compared growth at square spacings of 1.8 m, 2.4 m, 3 m, and 3.7 m. At both 5 and 8 years, the 3- by 3-m spacing yielded greater diameters and heights than narrower or wider spacings (*3*). The initial spacing of 2.4 m was best if tree form is the important criteria. All these spacings would have to be widened by later thinnings to sustain rapid growth. Diameter growth response was noted 5 years after thinning 35-year-old trees. Basal areas as high as 52 m^2/ha were reached without thinning, but reducing the basal area to 24.6 m^2/ha resulted in nearly double the diameter growth. Epicormic branches did not form on the boles of trees in these thinned stands (*32*).

Damaging Agents.—In the early 1950's, many fresno trees in Mexico City were killed by the bark beetle *Leperisinus fraxini* Panz. The recommended control was to fell and debark heavily infested trees and to apply insecticide to lightly infested trees (*16*). Some plantation trees in Puerto Rico were once heavily attacked by peach aphids (*Pseudaulacaspis pentagona* (Targioni-Tozzetti) (*9, 12*). Heart rot has hollowed many trees in sections of Puerto Rican plantations. Fresno logs and green lumber are quite susceptible to stain and insect damage (*22*), but most of the damage can be avoided by processing logs quickly and by dip-treating lumber immediately after sawing. Fresno wood from Mexico was found moderately resistant to rot by the fungi *Poria monticola, Lentinus lepideus,* and *Polyporus sanguineus* (*7*). The wood is not considered durable when in contact with the ground (*24*). No reference to termite resistance was found.

SPECIAL USES

In Mexico, Central America, and the Southwestern United States, fresno is a popular shade tree for streets, parks, and yards (*5, 8, 11*). The wood is reported to be very similar to white ash (*Fraxinus americana* L. (*13, 22*). Its color is blond to pale chestnut brown, with large pores and a straight grain. Fresno wood is not extensively exploited because of its scarcity within the native range, but it has many uses. The principal uses are baseball bats, tennis racquets, crafts, wooden kitchen utensils, furniture, and trim (*6*). The wood is also recommended for construction, flooring, mine props, shoe lasts, and veneer (*18, 22*). Fresno is easy to saw, plane, and machine (*22*). The wood density is 0.50 g/cm^3 (air-dried) and the shrinkage is lower than most hardwoods. The modulus of rupture is 900 kg/cm^2 and the modulus of elasticity is 117,000 kg/cm^2, (*22*).

[2]Personal communication, Craig Whitesell, USDA Forest Service, Pacific Islands Forestry, Honolulu, HI.

Table 1.—*Height, diameter, and survival of successful plantations of fresno (*Fraxinus uhdei*) growing in Hawaii and Puerto Rico*

Location	Precipitation	Elevation	Age	Average			Reference
				Height	D.b.h.	Survival	
	mm	*m*	*Yrs*	*m*	*cm*	*Percent*	
Mauna Loa, HI	5200	850	3	4	3.6	98	*(29)*
			10	8	11.4	96	*(29)*
	4120	1280	3	3	2.8	100	*(29)*
			11	6	3.4	83	*(29)*
Hamakua, HI	2800	640	5	7	.....	100	*(31)*
Kalopa, HI	2080	660	26	.....	26.9	.....	*(2)*
			42	.....	26.2	.....	*(2)*
	2080	700	32	.....	38.4	.....	*(2)*
			43	.....	39.1	.....	*(2)*
Waiakea, HI	5080	869*	9	13	11.7	100	*(30)*
		866*	9	13	10.9	87	*(30)*
	5080	550	5	8	7.1	100	*(3)*
			8	10	10.9	99	*(3)*
Cienaga Alta, PR	3040	500	5	5	5.8	94	†
			23	16	21.5	86	†
Toro Negro, PR‡	2500	900	54	14	25.4	.....	†

*Excludes badly eroded soils in plantations.
†Data on file at the Institute of Tropical Forestry, Rio Piedras, PR.
‡Underplanting trial (enrichment planting).

GENETICS

There are 26 species of *Fraxinus* (*33*). Fresno is closely related to white ash (*F. americana* L.) and was once considered to be a subspecies (*23*). The diploid chromosome number of white ash is 46, but it also occurs in the triploid and tetraploid forms (*33*). Fresno probably has a similar number of chromosomes. Genetic selection for form in fresno is recommended (*15*) but has not yet begun.

LITERATURE CITED

1. Bonner, F.T. 1974. *Fraxinus,* ash. In:Seeds of woody plants in the United States. Agric. Handb. 450. Washington, DC: U.S. Department of Agriculture. 883 p.
2. Buck, M.G.; Imoto, R.H. 1982. Growth of 11 introduced tree species in selected forest sites in Hawaii. Res. Pap. PSW-169. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 12 p.
3. Burgan, R.E. 1971. A spacing trial in tropical ash. . .an interim report. Res. Note PSW-226. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 3 p.
4. Carlson, Norman K.; Bryan, L.W. 1959. Hawaiian timber for coming generations. Honolulu, HI.Sponsored by: Trustees of the Bernice P. Bishop Estate. [n.p.].
5. Domir, S.C.; Roberts, B.R. 1981. Trunk injection of plant growth regulators to control tree regrowth. Journal of Arboriculture. 7(6): 141–144.
6. Guridi, G., L.I. 1980. La madera en las artesanias del estado de Michoacan. Boletín Divulgativo 50. Mexico City, Mexico: Instituto Nacional de Investigaciones Forestales. 127 p.
7. Herrera, Jaime A.; Gómez, María del Socorro; Barretero, Eduardo. 1980. Durabilidad natural de madera de catorce especies forestales Mexicanas. Boletín Técnico 67. Mexico City, Mexico: Instituto Nacional de Investigaciones Forestales. 19 p.
8. Holdridge, L.R.; Poveda, A., L.J. 1975. Arboles de Costa Rica. Vol. 1. San José, Costa Rica: Centro Científico Tropical. 546 p.
9. Hydrometerological Service of the USSR. 1977. Atlas of world water balance. Paris, France: The Unesco Press. [n.p.].
10. Lanner, R.M. 1964. Adventitious rooting—a response to Hawaii's environment. Res. Note 54. Berkeley, CA: U.S. Department of Agriculture, Forest Service. Pacific Southwest Forest and Range Experiment Station. 3 p.
11. Little, E.L., Jr.; Woodbury, R.O., Wadsworth, F.H. 1974. Trees of Puerto Rico and the Virgin Islands, Second Volume. Agric. Handb. 449. Washington, DC: U.S. Department of Agriculture. 1,024 p.
12. Martorell, Luis F. 1975. Annoted food plant catalog of the insects of Puerto Rico. Rio Piedras, PR: Agricultural Experiment Station, University of Puerto Rico. 303 p.

13. Mell, C.D. [n.d.]. Partial list of commercial species in Mexico. Internal Memo. Washington, DC: Foreign Economic Administration. 10 p.
14. Neal, M.C. 1965. In gardens of Hawaii. Spec. Pub. 50. Honolulu, HI: Bishop Museum Press. 924 p.
15. Nelson, R.E.; Schubert, T.H. 1976. Adaptability of selected tree species planted in Hawaii Forests. Resour. Bull. PSW-14. Berkeley, CA: U.S. Department of Agriculture, Forest Service. Pacific Southwest Forest and Range Experiment Station. 22 p.
16. Ortega C.H.; Verduzco G., J.; Gutiérrez P., A.; Piña L., I. 1951. Plagas y enfermadades del bosque de Chapultapec. Mexico City, Mexico: Dirección General Forestal y de Caza. 81 p.
17. Patiño V., F.; Villagomez A., Y. 1976. Los análisis de semillas y su utilización en la propagación de especies forestales. Boletín Devulgativo 40. Mexico City, Mexico: Instituto Nacional de Investigaciones Forestales. 26 p.
18. Pérez O., C.; Corral L., G. 1980. Estudio anatómico de la madera de once especies de angiospermas. Boletín Técnico 64. Mexico City, Mexico: Instituto Nacional Investigaciones Forestales. 77 p.
19. Roberts, B.R.; Wuertz, D.E.; Brown, G.K.; Kwolek, W.F. 1979. Controlling sprout growth in shade trees by trunk injection. Journal of the American Society of Horticultural Science. 104(6): 883–887.
20. Rzedowski, J. 1981. Vegetación de Mexico. Mexico City, Mexico: Editorial Limusa. 432 p.
21. Shukla, N.K.; Sangal, S.K. 1980. A preliminary note on the physical and mechanical properties of *Fraxinus uhdei* grown at New Forest, Dehra Dun (U.P.). Indian Forester. 106(9): 641– 644.
22. Skolmen, R.G. 1974. Some woods of Hawaii. . .properties and uses of 16 commercial species. Gen. Tech. Rep. PSW-8. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 29 p.
23. Standley, P.C. 1924. Contributions from the United States National Herbarium. Vol. 23, Part 4. Washington, DC: Smithsonian Institution, United States National Museum. 1,721 p.
24. Standley, P.C.; Williams, L.O. 1969. Flora of Guatemala. Fieldiana. 24(VIII, 4): 266–269.
25. Steinhauser, F. 1979. Climatic atlas of North and Central America. Budapest, Hungary: WMO, UNESCO Cartographia. 27 p.
26. Wagar, J.A.; Barker, P.A. 1983. Tree root damage to sidewalks and curbs. Journal of Arboriculture. 9(7): 117–181.
27. Walters, G.A. 1972. Coppicing to convert small cull trees to growing stock. Res. Note PSW-272. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 4 p.
28. Walters, G.A.; Wick, H.L. 1973. Coppicing to convert cull Australian toon, tropical ash to acceptable trees. Res. Note PSW-283. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 4 p.
29. Whitesell, C.D. 1976. Performance of seven introduced hardwood species on extremely stoney mucks in Hawaii. Res. Note PSW-309. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 5 p.
30. Whitesell, C.D. 1976. Underplanting trials in ohia rain forest. Res. Note PSW-319. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 4 p.
31. Whitesell, C.D.; Walters, G.A. 1976. Species adaptability trials for man-made forests in Hawaii. Res. Pap. PSW-118. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 30 p.
32. Whitesell, C.D.; Wick, H.L.; Honda, N. 1971. Growth response of a thinned tropical ash stand in Hawaii. . . after 5 years. Res. Note PSW-227. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 3 p.
33. Wilson, K.A.; Wood, C.E., Jr. 1959. The genera of Oleaceae in the Southeastern United States. Journal of the Arnold Arboretum. 40: 369–375.
34. Wright, J.W. 1959. Silvical characteristics of white ash. Sta. Pap. 123. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 19 p.